09-18-00 A

jc930 U.S. PTO

09/15/00

Docket No. **004946**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

JC564 U.S. PTO
09/663862
09/15/00

Re: Inventor(s): **Shinichi Kurita & Wendell T. Blonigan**
Title: **Double Dual Slot Load Lock for Process Equipment**

Transmitted herewith is the patent application identified above, including:

X Specification, claims and abstract, totaling 20 pages.

X Drawings totaling 8 pages, X Formal __ Informal.

X Executed Declaration and Power of Attorney.

X Assignment of the invention to **Applied Materials, Inc.**

X Assignment Recordation Cover Sheet

FEE CALCULATION

Fee Items	Claims Filed	Included With Basic Fee	Extra Claims	Fee Rate	Total
Total Claims	24	- 20 =	- 4	X $18	$72
Independent Claims	- 1	- 3 =	- 0	X $78	$0
Basic Filing Fee				$690	$690
TOTAL FEES					**$762**

XX The Commissioner is hereby authorized to charge $762 to Deposit Account No. 50-1074.

XX The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1074. A duplicate copy of this transmittal is enclosed.

XX Please address all future correspondence to:

PATENT COUNSEL
APPLIED MATERIALS, INC.
Legal Affairs Department
P.O.BOX 450A
Santa Clara, CA. 95052

I hereby certify that this correspondence is being deposited with the United States Postal Service as express mail in an envelope addressed to Box Patent Application, Assistant Commissioner for Patents, Washington, D C 20231

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Respectfully submitted,

[signature]
Robert W. Mulcahy
Registration No. 25,436

DOUBLE DUAL SLOT LOAD LOCK FOR PROCESS EQUIPMENT

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to the fields of semiconductor manufacturing. More specifically, the present invention relates to a semiconductor wafer or glass substrate processing system comprising a double dual slot load lock and uses thereof.

Description of the Related Art

The need for greater throughput and yield in the manufacture of semiconductor devices has driven the development and use of more highly automated wafer processing

machines. Also, the desire to minimize wafer particulate contamination during processing has led to the use of vacuum load locks and wafer transport mechanisms which operate in vacuum.

In continuous throughput systems, wafers must be introduced into the vacuum chamber through a load lock in order to prevent exposing the vacuum condition in the chamber to the air outside the chamber. When a wafer is to be loaded into the chamber, the inner closure means, such as a sealing plate, is activated to seal the inner side of the opening, and then the outer closure means, such as a sealing door, is opened. Next the door is opened, a wafer is inserted through the opening, and the door is again closed. The load lock chamber now containing the wafer is pumped down to contain an atmosphere compatible with the atmosphere in the processing vacuum chamber, and then the inner sealing plate is moved away from the opening to expose the wafer for processing in the main vacuum chamber. To increase the throughout, some systems employ two load lock chambers so that processing of wafers can continue uninterrupted by a delay caused by the need to open, empty, reload and re-equilibrate a single load lock chamber.

Despite the increased vacuum isolation, the state-of-the-art systems typically have difficulty providing commercially acceptable throughput for high vacuum processes. Presently, typical load lock chambers employ sliding or rotating valves to isolate a single wafer. Such load locks require a pumpdown cycle for each wafer processed and thus inhibit throughput. In

addition, the load locks are typically in-line devices; that is, wafers pass in a straight line through the load lock. This substantially contributes to the overall width of the wafer processing machine. Furthermore, in the prior art designs, mechanical feedthroughs, which are used to transmit motion through a vacuum seal, have not been adequate to the task of simultaneously operating a load lock valve and indexing an internal wafer cassette.

Therefore, the prior art is deficient in the lack of effective system/means of processing substrates in a high throughput fashion and meanwhile minimizing particulate contamination during processing. Specifically, the prior art is deficient in the lack of a highly automated substrate processing system comprising double dual slot load locks constructed at one body. The present invention fulfills this long-standing need and desire in the art.

SUMMARY OF THE INVENTION

In one aspect of the present invention, there is provided a substrate processing system, which comprises a cassette load station; a load lock chamber; a centrally located transfer chamber; and one or more process chambers located about the periphery of the transfer chamber. In this system, the load lock chamber comprises two dual slot load locks constructed at same location.

In another aspect of the present invention, there is provided a method of processing substrates in the system disclosed herein for semiconductor manufacturing. This method comprises the following steps: first, moving substrates from the cassette load station to the transfer chamber through the load lock chamber; secondly, transferring the substrates from the transfer chamber to the process chambers; thirdly, processing the substrates in the process chambers; and lastly, unloading the processed substrates from the process chambers to the same cassette load station through the same load lock chamber. In this method, one load lock is in a vacuum condition and the other load lock is in an atmospheric/venting condition at the same time.

Other and further aspects, features, and advantages of the present invention will be apparent from the following description of the embodiments of the invention given for the purpose of disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

So that the matter in which the above-recited features, advantages and objects of the invention, as well as others which will become clear, are attained and can be understood in detail, more particular descriptions of the invention briefly summarized above may be had by reference to

certain embodiments thereof which are illustrated in the appended drawings. These drawings form a part of the specification. It is to be noted, however, that the appended drawings illustrate embodiments of the invention and therefore are not to be considered limiting in their scope.

Figure 1 is an overview of the presently disclosed system, i.e., AKT Gen4 with AGV/MGV interface and atmospheric cassette load station (ACLS), comprising a cassette load station **101**, a load lock chamber **102**, a central transfer chamber **103**, one or more process chambers **104**, a heat chamber **105**, and control towers and gas chamber **106**.

Figure 2 is an overview of system AKT Gen4 with a substrate transferring link **107**.

Figure 3 is a side view of double dual slot load lock and transfer chamber construction in system AKT Gen4.

Figure 4 is a schematic drawing demonstrating loading and unloading of a pre-processed substrate using the double dual slot load lock, wherein the substrate is loaded from ACLS to the upper load lock, and then unloaded to the transfer chamber through the lower load lock.

Figure 5 is a schematic drawing demonstrating loading and unloading of a pre-processed substrate using the double dual slot load lock, wherein the substrate is loaded from

ACLS to the lower load lock, and then unloaded to the transfer chamber through the upper load lock.

Figure 6 is a schematic drawing demonstrating loading and unloading of a processed substrate using the double dual slot load lock, wherein the substrate is loaded from the transfer chamber to the lower load lock, and then unloaded to ACLS through the upper load lock.

Figure 7 is a schematic drawing demonstrating pumping and venting processes which take place in the double dual slot load lock. Specifically, filtered diffuser N_2 vent is used for cooling a processed substrate when venting.

Figures 8A-8C show system size comparison among AKT5500 (state-of-art system) (**Figure A**), AKT stretch (**Figure B**), and AKT Gen4 (**Figure C**). The AKT stretch is 133% stretch of AKT5500 and a traditional approach to AKT Gen4. Both AKT5500 and AKT stretch have two dual slot load locks which are constructed at two locations, whereas AKT Gen4 has one double dual slot load lock.

DETAILED DESCRIPTION OF THE INVENTION

Provided herein is a semiconductor wafer processing system, comprising a cassette load station **101**, load lock chamber **102**, a central transfer chamber **103**, one or more process chambers **104**, a heat chamber **105**, and control towers and gas chamber **106** (Figure 1).

The load lock chamber **102** is provided for transferring wafers between the transfer chamber **103**, which is typically at high vacuum, and the outside, typically a clean room at atmospheric pressure. The central transfer chamber **103** is provided with a vacuum transfer robot located therein for transferring wafers between the load lock chamber **102** and the process chambers **104**/heat chamber **105**, which are located about the periphery of the transfer chamber **103**. Figure 2 is an over view of the system with substrate transferring link **107**.

Specifically, the load lock chamber **102** comprises double dual slot load lock constructed at one body (i.e., one location, in one chamber). Each load lock has dual slot load lock (DSL) function: upper slot for loading pre-processed substrate from cassette load station **101** (atmospheric side); and lower slot for unloading processed substrate to cassette load station **101** (atmospheric side). In most cases, the substrate is a wafer or a glass substrate.

Substrates are loaded/unloaded by both vacuum robot and atmospheric robot. Vacuum robot in the central

transfer chamber **103** passes substrates through slit valves in the various connected processing chambers **104** or heater chamber **105** and retrieves them after processing in the chambers is complete. Access between the individual process chambers **104** and between the transfer chamber **103** and the load lock chamber **102** is via flip door type slit valves which selectively isolate the process chambers **104** or heat chamber **105** from the robot (in transfer chamber **103**) and the robot from the load lock chamber **102**. However, the load lock chamber at the atmospheric side may have other than flip door type slit valves. Other doors may also be used to separate the vacuum condition in the load lock chamber from the atmospheric condition outside the chamber.

Figure 3 is a system side view showing the construction of double dual slot load lock and the transfer chamber. The flip type valve is closed from the atmospheric side, which makes it possible to keep load lock vacuum condition with small torque actuator. The valve is always operated below the substrate transferring plane to reduce particle exposure and opens before loading and unloading of a substrate.

This system configuration permits processing in one or more chambers while wafers are being loaded or unloaded at other process chambers or at the load lock chamber and permits wafer transfer from one processing chamber to another via the transfer chamber. Different processes may be simultaneously performed on different substrates at different process chambers. Each wafer which is dispensed from load lock may be stepped

through the same process steps to produce the same type of wafer. Alternatively, different wafers from the same load lock may be programmed to undergo a different "recipe" involving different steps and/or process times, such that different types of wafers are produced.

Specifically, the vacuum robot was operated by Z-drive in an up-and-down motion. The Z-drive shaft is a vacuum seal constructed in chambers with nitrogen purge and vacuum at the same time.

The above-disclosed system can be used for processing substrates for semiconductor manufacturing. In more specific detail, pre-processed substrates are loaded into the upper slot in one of the load locks from the cassette load station (Figures 4-5). The upper slot optionally has a heating plate for heating up the substrates. The heating plate is either a stationary plate or a moving plate. It can approximate to the substrates by Z drive to increase the heating efficiency. During pumping, the heating temperature can be up to 400°C. The heated substrates are then unloaded from the other load lock to the transfer chamber, and further to the process chambers for processing, or to the heat chamber for either preheating or annealing.

After processing in the chambers is complete, the processed substrates are then unloaded from the lower slot in one of the load locks to the cassette load station (Figure 6). Lower slot has a cooling plate for cooling down the processed substrates. The cooling plate is either a stationary plate or

moving plate and it can approximate to the substrates by Z drive to increase the cooling efficiency. Also, a small amount of helium gas (He) can be supplied with nitrogen gas (N_2) for cooling. Filtered diffuser N_2 vent is used to prevent particle generation in the load locks (Figure 7). During venting, the temperature can be cooled down from 350°C to 80°C. When operated, each load lock loads and unloads substrates separately. Normally, one is venting and the other is pumping so that the vacuum pump can be shared between the two load locks.

The double dual slot load lock (DDSL) system disclosed herein provides several advantages in comparison with traditional one DSL system, such as AKT5500 or AKT stretch (Figures 8A-8C). First, constructing two dual slot load lock at one body (one location) can increase system cost performance, i.e., minimize system footprint and increase system throughput that was restricted by the load lock pumping/venting activity. For a traditional one dual slot load lock system (with 4 process chambers), the system maximum throughput determined by the load lock activity is approximately 30 substrate/hour. In contrast, for one embodiment of the double dual slot load lock system disclosed herein, the system maximum throughput is approximately 60 substrate/hour. For example, a single layer firm (passivation) process has a throughput of approximately 26 substrate/hour for traditional one DSL system, while for one embodiment of the double dual slot load lock system disclosed herein, the passivation process has a throughput of approximately 50 substrate/hour. Since the throughput is restricted by load lock activity, a traditional one DSL system with

3 process chambers has the same throughput as the one with 4 process chambers. For active layer process, a traditional one DSL system (with 4 process chambers) has a throughput of approximately 18 substrate/hour, the same as for one embodiment of the double dual slot load lock system disclosed herein. In this case, the system throughput is the same for both one and double DSL systems, therefore system can use one of the two dual slot load lock. Most customers prefer a system that is capable of switching the process based on the production situation, therefore the system has to be configured to handle quick process. For example, the system can be configured to have shorter process time, or change process time based on process data.

Another advantage of using the presently disclosed double dual slot load lock system is its compact size. The double dual slot load lock system requires narrower atmospheric cassette load station than two DSL systems. For grand transportation, there is an equipment size limitation of approximate 3.0 m in dimension. In one embodiment of the double dual slot load lock system, the transfer chamber is designed in a shape of heptagon and the maximum process chamber quantity is 5. To meet the same size requirement, for two DSL systems, the maximum process chamber quantity would be 3.

Therefore, a substrate processing system is hereby provided. which comprises a cassette load station, a load lock chamber, a transfer chamber, and one or more process

chambers. The transfer chamber is centrally located, and the multiple process chambers are located about the periphery of the transfer chamber. The load lock chamber comprises two dual slot load lock constructed at one location.

Specifically, each dual slot load lock has a heating plate and a cooling plate located in different slots. The heating plate is a stationary plate or moving plate operated by Z-drive, and can heat the temperature up to 400°C during pumping. Similarly, the cooling plate is a stationary plate or moving plate operated by Z-drive, and can cool the temperature down from about 350°C to about 80°C during venting. More specifically, the cooling is achieved by water or by venting using nitrogen gas mixed with helium.

The substrate processing system described herein may further comprise a vacuum robot, which is located in the transfer chamber for transferring substrates. The vacuum robot is operated by Z-drive. Still, the system may further comprise a flip type door located between the cassette load station and the load lock chamber. Flip type slit valves may also be constructed between the load lock chamber and the transfer chamber. Such slit valves are closed from atmospheric side and always operated below substrate transferring plane to reduce particle exposure. Still yet, the substrate processing system may further comprise filter diffusers, which are located in the both dual slot load locks to prevent particle generation.

Further provided is a method of processing substrates using the above-disclosed system for semiconductor manufacturing. This method comprises the steps of moving substrates from the cassette load station to the transfer chamber through the load lock chamber; transferring the substrates from the transfer chamber to the process chambers; processing the substrates in the process chambers; and unloading the processed substrates from the process chambers to the cassette load station through the load lock chamber. In this method, one of the dual slot load locks is in a vacuum condition for unloading pre-processed substrates from the load lock chamber to the transfer chamber, whereas at the same time the other dual slot load lock is in an atmospheric condition for unloading processed substrates from the load lock chamber to the cassette load station.

Furthermore, the pre-processed substrates are heated up to about 400°C before loading to the transfer chamber. The heated substrates are then transferred to the transfer chamber by a vacuum robot which is driven by Z-drive. After processing, the processed substrates are cooled down from about 350°C to about 80°C before loading to the cassette load station. To increase cooling efficiency, a small amount of helium gas is supplied with nitrogen gas. Alternatively, the cooling can be achieved by water.

In this method, one load lock is in a vacuum condition and at the same time, the other load lock is in an atmospheric/venting condition. One vacuum pump is shared between the two load locks. Additionally, filter diffusers are located on both load locks to prevent particle generation.

Increased vent speed may also be used to further prevent particle generation.

The system/method disclosed herein provides an improved wafer support and transport means to enable automatic and repetitive moving of individual wafers into and from load locks into, through and between processing chambers while minimizing damage and contamination of wafers. Additionally, using two dual slot load lock constructed in the same chamber increases system cost performance, i.e., minimizes system footprint and increases system throughput that was restricted by the load lock pumping/venting activity.

Any patents or publications mentioned in this specification are indicative of the levels of those skilled in the art to which the invention pertains. These patents and publications are herein incorporated by reference to the same extent as if each individual publication was specifically and individually indicated to be incorporated by reference.

One skilled in the art will readily appreciate that the present invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. It will be apparent to those skilled in the art that various modifications and variations can be made in practicing the present invention without departing from the spirit or scope of the invention. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention as defined by the scope of the claims.

WHAT IS CLAIMED IS:

1. A substrate processing system, comprising:

a cassette load station;

a load lock chamber, wherein said load lock chamber comprises double dual slot load lock constructed at same location;

a transfer chamber, wherein said transfer chamber is centrally located; and

one or more process chambers, wherein said process chambers are located about the periphery of said transfer chamber.

2. The substrate processing system of claim 1, wherein said substrate is a wafer or a glass substrate.

3. The substrate processing system of claim 1, wherein said dual slot load lock has a heating plate and a cooling plate, wherein said heating plate and cooling plate are located in different slots.

4. The substrate processing system of claim 3, wherein said heating plate is a stationary plate or a moving plate.

5. The substrate processing system of claim 4, wherein the moving heating plate is operated by Z-drive.

6. The substrate processing system of claim 3, wherein said heating plate heats up to a temperature of about 400°C.

7. The substrate processing system of claim 3, wherein said cooling plate is a stationary plate or moving plate.

8. The substrate processing system of claim 7, wherein the moving cooling plate is operated by Z-drive.

9. The substrate processing system of claim 3, wherein said cooling plate cools the temperature down from about 350°C to about 80°C.

10. The substrate processing system of claim 9, wherein said cooling is done by water or by nitrogen gas.

11. The substrate processing system of claim 10, wherein said nitrogen gas is mixed with helium.

12. The substrate processing system of claim 1, further comprising:

a vacuum robot, wherein said vacuum robot is located in said transfer chamber and load/unload the substrate between said load lock chamber and said transfer chamber.

13. The substrate processing system of claim 12, wherein said vacuum robot is operated by Z-drive.

14. The substrate processing system of claim 1, further comprising:

a flip type door, wherein said door is located between the cassette load station and the load lock chamber.

15. The substrate processing system of claim 1, further comprising:

flip type slit valves, wherein said valves are located between the load lock chamber and the transfer chamber.

16. The substrate processing system of claim 15, wherein said valves are closed from atmospheric side and operated below substrate transferring plane.

17. The substrate processing system of claim 1, further comprising:

filter diffusers, wherein said filter diffusers are located in the double dual slot load locks to prevent particle generation in said load locks.

18. A method of processing substrates in the system of claim 1 for semiconductor manufacturing, comprising the steps of:

moving pre-processed substrates from the cassette load station to the transfer chamber through the load lock chamber;

transferring said substrates from said transfer chamber to the process chambers;

processing said substrates in said process chambers; and

unloading the processed substrates from said process chambers to said cassette load station through said load lock chamber; wherein first dual slot load lock in said load lock chamber is in a vacuum condition for unloading pre-processed substrates from said load lock chamber to said transfer chamber, whereas at the same time second dual slot load lock in said load lock chamber is in an atmospheric condition for unloading processed substrates from said load lock chamber to said cassette load station.

19. The method of claim 18, wherein said substrate is a wafer or glass substrate.

20. The method of claim 18, wherein the moving step further comprising the step of:

heating said pre-processed substrates in said first dual slot load lock to a temperature of up to about 400°C.

21. The method of claim 18, wherein the transferring step is performed by a vacuum robot driven by Z-drive.

22. The method of claim 18, wherein the unloading step further comprising the step of:

cooling said processed substrates in said second dual slot load lock from about 350°C to about 80°C.

23. The method of claim 22, wherein said cooling is done through venting using small amount of helium gas mixed with nitrogen gas.

24. The method of claim 22, wherein said cooling is done by water.

ABSTRACT OF THE DISCLOSURE

Provided herein is a substrate processing system, which comprises a cassette load station; a load lock chamber; a centrally located transfer chamber; and one or more process chambers located about the periphery of the transfer chamber. The load lock chamber comprises double dual slot load locks constructed at same location. Such system may be used for processing substrates for semiconductor manufacturing.

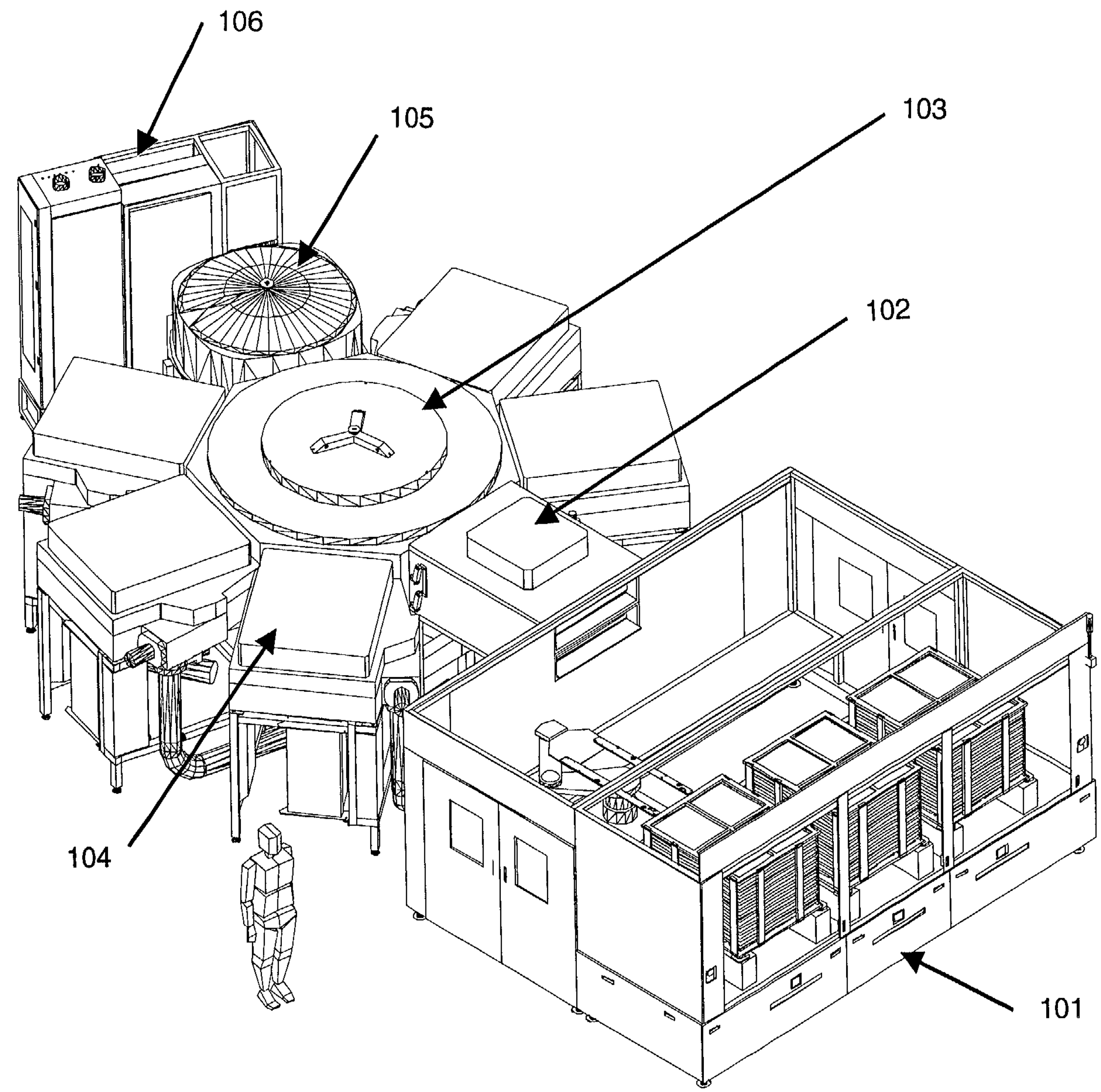


FIG. 1

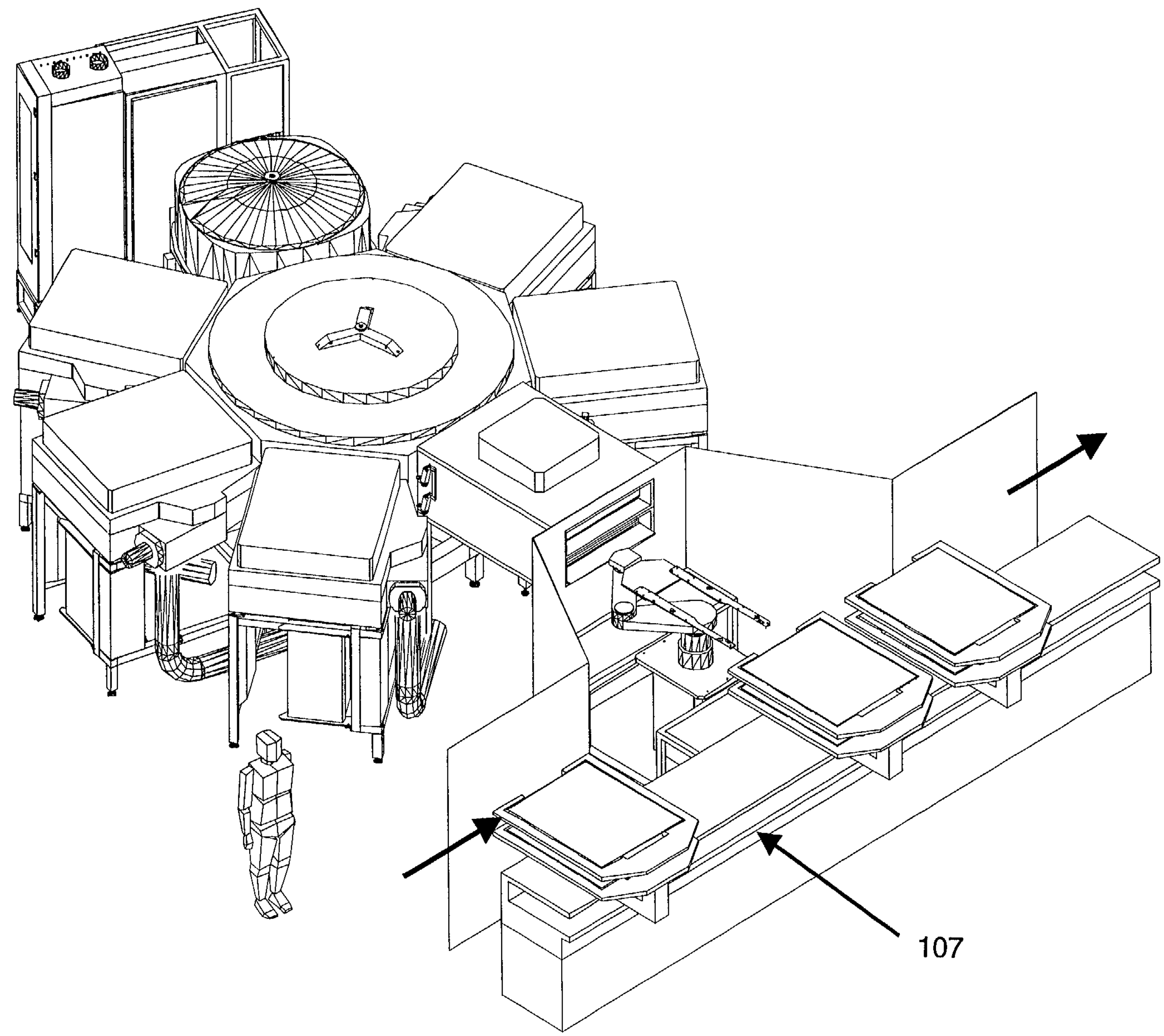


FIG. 2

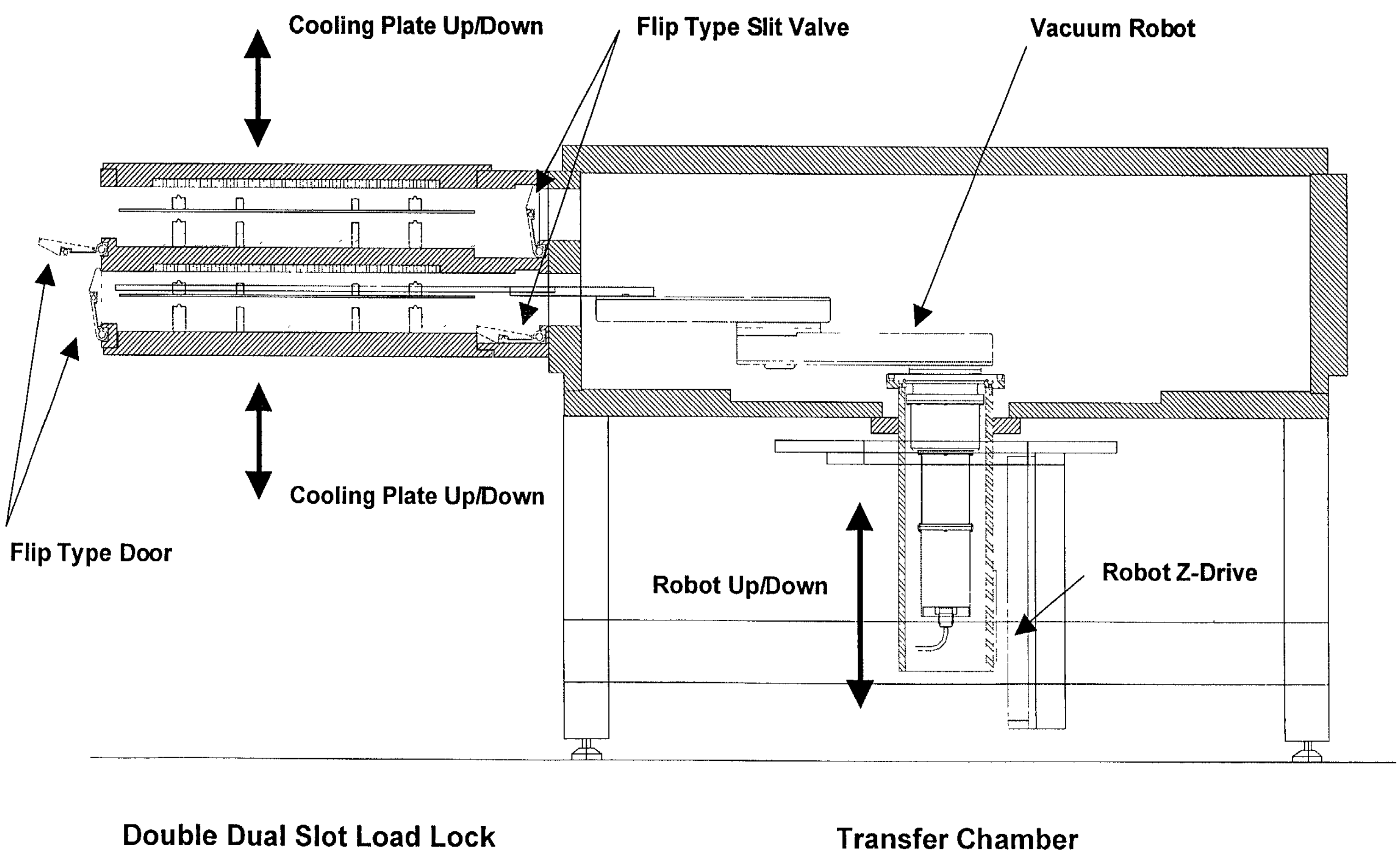
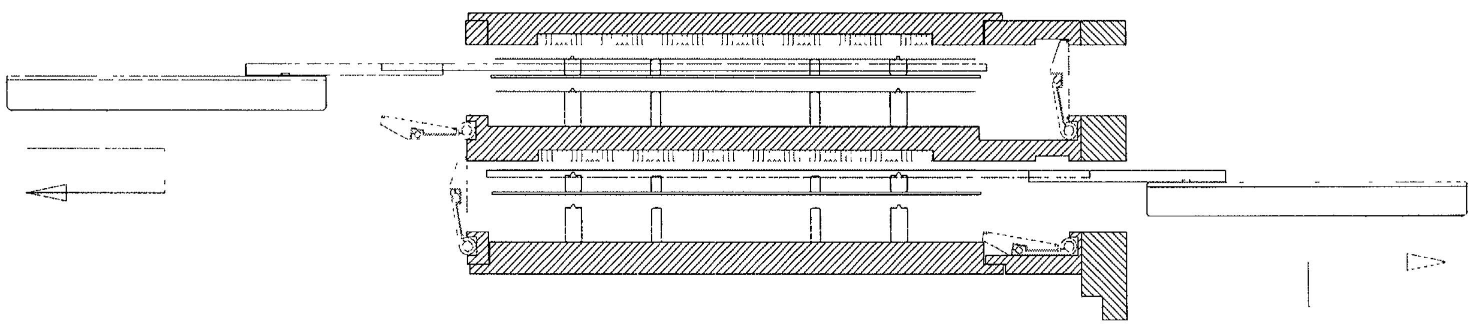

Cooling Plate Up/Down
Flip Type Slit Valve
Vacuum Robot
Cooling Plate Up/Down
Flip Type Door
Robot Up/Down
Robot Z-Drive
Double Dual Slot Load Lock
Transfer Chamber

FIG. 3



ACLS Side
Load a Pre-processed Substrate

DDSL

Transfer Chamber Side
Unload a Pre-processed Substrate

FIG. 4

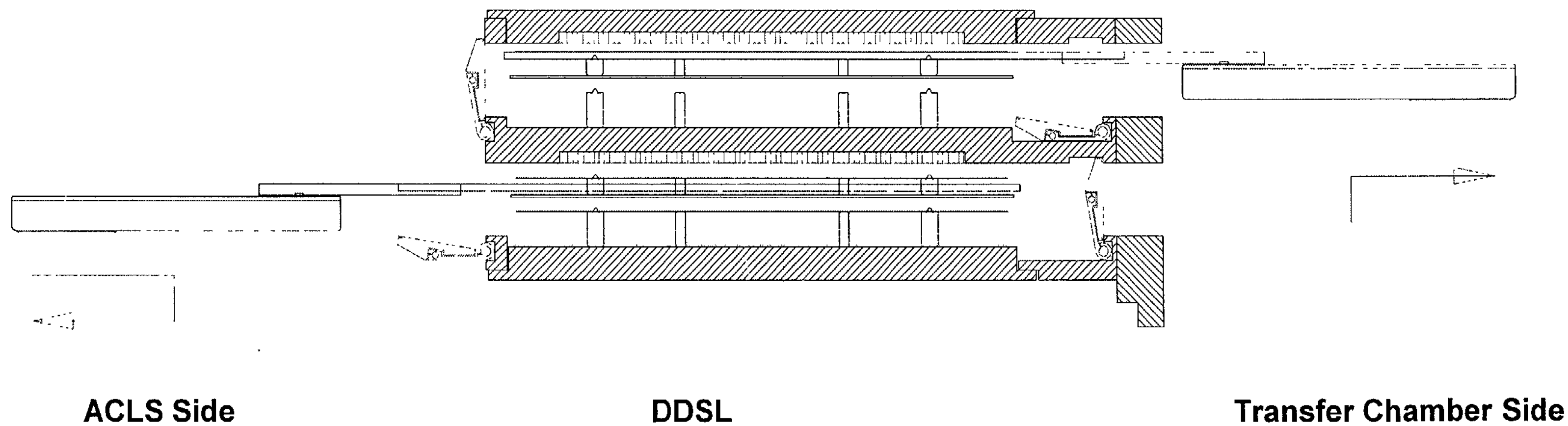
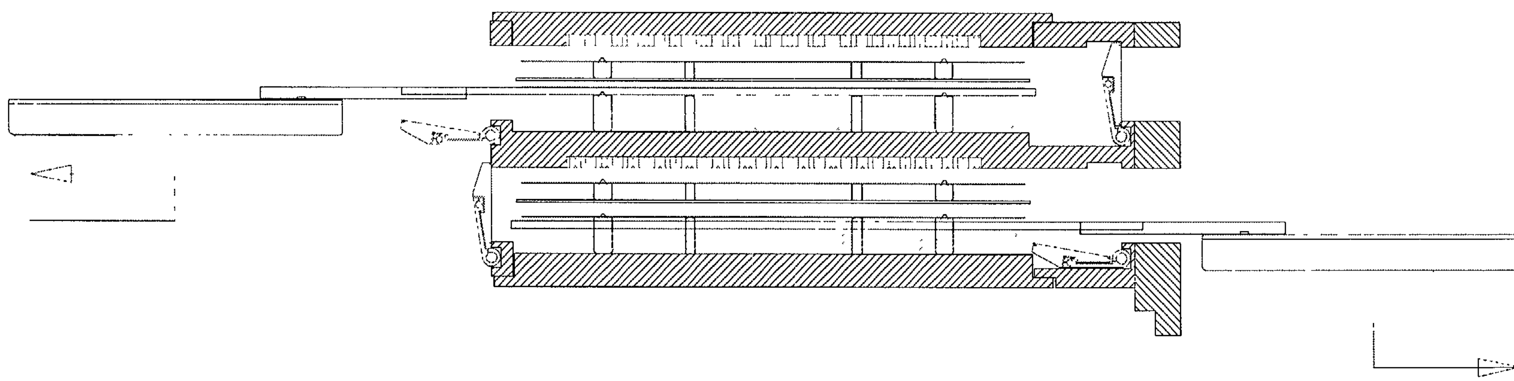


FIG. 5



ACLS Side
Unload a Processed Substrate

DDSL

Transfer Chamber Side
Load a Processed Substrate

FIG. 6

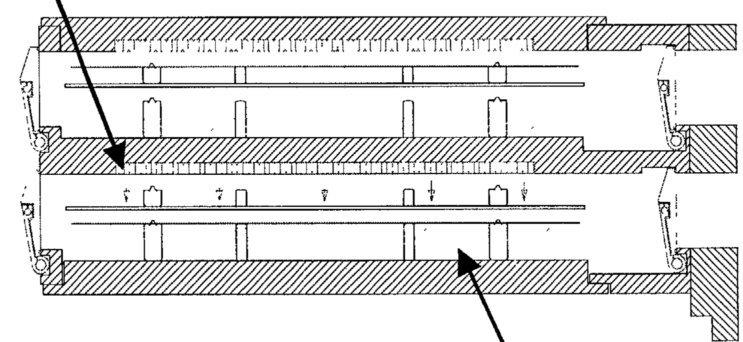

Filtered Diffuser
N2 Vent
Pumping
Venting
Cooling a Substrate
ACLS Side
DDSL
Transfer Chamber Side
Cooling Plate

FIG. 7

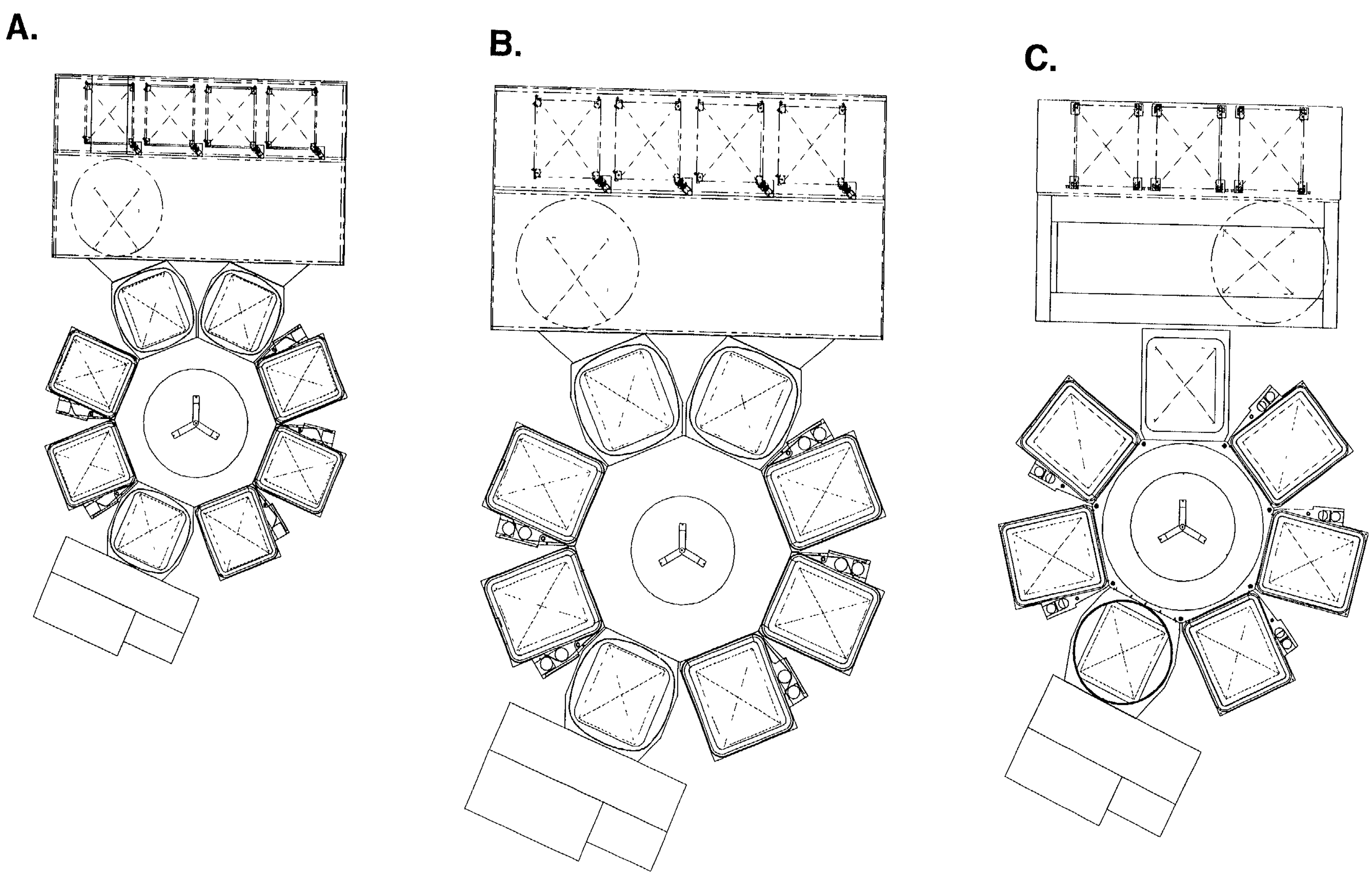


FIG. 8

Atty. Dkt. No. **004946**

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

[X] original
[ ] divisional
[ ] continuation
[ ] continuation-in-part

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

Double Dual Slot Load Lock for Process Equipment

SPECIFICATION IDENTIFICATION

The specification of which:

[X] is attached hereto
[ ] was filed on {Filing Date}, under Serial No. {Serial No.}, executed on even date herewith; or [ ] Express Mail No.(as Serial No. not yet known) and was amended on ______________ (if applicable)
[ ] was described and claimed in PCT International Application No. ________________ filed on ______________ and as amended under PCT Article 19 on ______________.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with Title 37, Code of Federal Regulations, 1.56, and which is material to the examination of this application; namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

[ ] In compliance with this duty there is attached an Information Disclosure Statement in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. §119)

I hereby claim foreign priority benefits under Title 35, United States Code, §119, of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America or of any United States Provisional Application(s) listed below, and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

[X] No such applications have been filed.

[ ] Such applications have been filed as follows:

A. Prior foreign/PCT/provisional application(s) filed within 12 mos. (6 mos. for design) prior to this application, and any priority claims under 35 U.S.C. § 119

Country/PCT	Application No	Date Filed	Priority Claimed
			[ ] Yes [ ] No
			[ ] Yes [ ] No

B. All foreign application(s), if any, filed more than 12 mos. (6 mos for design) prior to this U.S. application

Country:
Application No:
Filing date:

PRIORITY CLAIM (35 U.S.C. §120)

I hereby claim the benefit under Title 35, United States Code, § 120, of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, '112, I acknowledge the duty to disclose information that is material to the examination of this application (namely, information where there is substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

[X] No such applications have been filed
[ ] Such applications have been filed, as follows:

Serial No.	Filing Date	Status	
		Patented Pending	Abandoned

POWER OF ATTORNEY

I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Peter J. Sgarbossa	Registration No. 25,610
Donald Verplancken	Registration No. 33,217
Lawrence Edelman	Registration No. 25,226
Michael B. Einschlag	Registration No. 29,301
Joseph Bach	Registration No. 37,771
Raymond Kam-On Kwong	Registration No. 37,165
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Robert W. Mulcahy	Registration No. 25,436
Sarah Brashears	Registration No. 38,087
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Santa Clara, CA 95052

Direct telephone calls to:

Benjamin Aaron Adler
713/777-2321

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Full name of **first** inventor: Shinichi Kurita

Inventor's signature: ______________________ Date: 9/14/00

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Country of Citizenship: Japan

Full name of **second** inventor: Wendell T. Blonigan

Inventor's signature: ______________________ Date: 9/14/00

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Country of Citizenship: U.S.A.

(Declaration ends with this page)